Modeling Convection

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One of the most important advances needed in global climate models is the development of models that can reliably treat convection. At the present time, convection is a sub-grid process that must be parameterized. Accurate treatment during convective events requires solution of the equations of motion in a non-hydrostatic framework, while typically climate models treat only the large-scale flow, for which the simplifying assumption that the flow is hydrostatic is accurate.

This project will result in a climate model that self-adjusts the grid resolution and the complexity of the physics model to the actual atmospheric flow conditions. Calculations with the non-hydrostatic model are only performed where judged necessary by a convective instability criterion, thereby keeping computer requirements to a minimum. Horizontal grid refinement will occur throughout the physics regimes as needed to accurately predict solutions of the primitive equations. The development of a single method that solves different physics in different domains is a code-development challenge that is encountered more and more often in today's scientific-computing arena.